CONSTRUCTION

To facilitate deep learning in Construction topics and practical projects have been carefully designed and sequenced by the following rationale:

- Topics of knowledge build 'chronologically' beginning by looking at the bigger picture of the scale and importance of construction globally, both past and present. It's scope and scale.
- Student must know the key performance requirements of a low rise building so that they can understand better how buildings are designed to achieve these requirements.
- Students must know the key construction elements of a typical building: how these are specified and constructed
- Developing an understanding of the environmental impact of construction at the design, planning and building stages, and consider a range of sustainable construction practices
- Build a practical understanding of materials and their properties: how do they behave and how does this determine their fitness for purpose?
- Students must be able to communicate design ideas using standard drawing practices such as 1 and 2 point perspective, and interpret technical data from formal orthographic plan drawings
- Once equipped with this foundation of knowledge and skills, students must then be able to develop a more informed understanding of construction. How does construction impact society and the economy? How does the construction industry move forward responsibly?

By the end of their education in Construction at Callington Community College, all students will be able to:

- Identify activities and sectors of the construction industry, and be able to discuss the social and economic impacts that construction has both locally, nationally and globally
- Identify key elements in the construction of low rise buildings, describe their purpose and explain how they are designed and constructed
- Be able to articulate the global importance of sustainable construction and how the construction industry has an impact on the global environment
- Identify and explain the key objectives behind construction, and the performance requirements for low rise buildings
- Identify and apply mathematical formula in order to calculate area, volume and scientific data such as force
- Identify and explain how key scientific concepts relate to and inform construction including different types of load, how forces are transmitted through a building and how material properties determine fitness for purpose

YEAR 10 TERM 1

Construction technology
Understand the structural performance required for low-rise construction
PERFORMANCE REQUIREMENTS **The in-situ requirements for elements of a building, the characteristics, properties, location, features and applications, and the interaction of different elements making up the sub-structure and superstructure. Learners will need to be able to demonstrate the use of sketching techniques.**
STUDENTS WILL KNOW AND REMEMBER…
How buildings are designed and constructed, considering: • strength • stability • fire resistance

- thermal insulation
- sound insulation
- weather resistance
- sustainability.

Strength and stability
Buildings are designed to resist live, dead and dynamic loads to include:

- self-weight
- use
- snow
- wind.

How buildings achieve their required strength – for the following, understand what is required, where it is required, why it is done and how it is achieved:

- tested materials: grading of hard core, slump testing and compressive testing of concrete, stress grading of structural timber, mortar testing
- specification of materials: British Standards, (EN) European numbers, strength classifications of concrete, bricks, blocks, mortar, timber
- cavity walls: construction to provide composite strength and stability, building regulation requirements for buildings not exceeding 12 m high, including wall-tie spacing, height restrictions
- lateral and vertical restraint: internal walls, floor- and roof-tie positions, resist the spread of the walls, resist uplift from wind loadings
- transfer of loads to foundations: roof to walls, floors to walls.

Fire resistance. How buildings are protected against fire and maintain their structural integrity – for the following, understand what is required, why it is done and how it is achieved:

- fire-resistant materials which include plasterboard, concrete, blockwork, intumescent paint
- fire compartments and fire barriers (separating building design requirements – walls, separating floors, door closes, fire-resistant doors), fire escapes, refuge areas, cavity fire barriers, fire alarm systems, smoke detection, sprinkler system.

Thermal insulation. How buildings are insulated against heat loss – for the following, understand why it is done, what types of thermal insulation and resistant materials are used, and where it is provided:

- purpose of insulation: reduction of heat loss from a building, energy costs,
  prevention of the loss of heated air through gaps within a building or structure, providing an acceptable U-value in accordance with regulations
- types of insulation: sheep's wool, mineral wool, glass fibre, cellulose, foam,
  advantages of one type over another
- types of thermally resistant materials: aerated lightweight concrete blocks, timber,
  lightweight screeds
- location: cavity insulation, wall insulation, roofing insulation, flooring insulation, double glazing, draught strips.

Sound insulation. How buildings meet their required sound resistance – for the following, understand why it is used, what is required to be provided, where it is required, and how sound resistance is achieved:

- purpose: to resist the passage of sound through a structure, preventing nuisance and noise disturbance of adjacent neighbours, reduce external infrastructure noise, reduce aircraft noise, provide confidentiality
- types of sound insulation: triple glazing, heavy-density blockwork, sound insulation quilt, plasterboard layers, flooring mats, carpeting, acoustic ceilings
- location: floor, wall and ceiling construction between adjacent rooms and flats, party walls, internal partition walls, windows, door
- provision: adding material density, utilisation of robust design details, sound isolation of structures, reduction of transference by using machinery silencers.

Weather resistance. How buildings achieve their resistance to the weather elements – for the following, understand why it is done, what types of materials are used, and where they are provided:

- purpose: to keep occupants in an acceptable environment, thermal comfort of occupants, humidity levels, prevention of damage to finishes, prevention of water staining
- materials: selection of waterproof and impervious materials, double glazing, use of falls, weather seals and sealants, flashings, soffits
- location: guttering, window and door openings, external walls, ventilation ducts, roof finishes, overhanging eaves.

Sustainability. Sustainability is preserving resources for future generations and minimising the impact of construction activities on the natural environment. For the following, understand why it is done, how it is achieved, what sustainable materials are used for construction and where they are used:

- purpose: reduction in building energy use, conserving finite resources, reduction in carbon emissions to the atmosphere, reduction in pollution and wastage
- methods: building orientation for light and heat in the UK, reduction in the use of greenfield sites, brownfield re-use of sites, recycling waste materials into new products, low embodied energy materials, green renewable natural materials, using local suppliers, prefabrication of elements, reduction in construction wastage
- materials:
    - hemp, lime, rendering finishes
    - sheep's wool insulation
    - straw construction of walls
    - timber: cedar cladding, softwoods in timber framing
    - aluminium: guttering, downpipes.

Common structural forms for low-rise construction. For the following construction methods, understand how they are designed and detailed, what the terminology of each component is called, how and why each method differs, and the advantages and disadvantages of each structural form. Learners will need to be able to demonstrate the use of sketching techniques.

STUDENTS WILL KNOW AND REMEMBER…

- traditional cavity wall construction: load-bearing elements; brickwork and blockwork, blockwork outer and blockwork inner with external rendered finishes (hemp, brickwork)
- cross-wall construction: load-bearing cross-wall element, relationships of connecting floors, prefabricated concrete cross wall, use of cross-wall construction in accommodation units
- structural: insulated panels (SIPS), panel finishes (brickwork, blockwork and render, insulation and timber cladding, hemp rendering, tiling), panel function (panel design to support load), position of insulation
- timber-framed construction: timber framing use, position of insulation, vapour/moisture barriers including damp-proof membranes, position of plywood on panels, connection binder details, external brick cladding, methods of tying external finish to supporting panel, formation of openings, panel/secondary finishes (brickwork, blockwork and render, insulation and timber cladding, hemp rendering, tiling), panel function (panel design to support load).

Explore how sub-structures are constructed

Preconstruction work. For the following activities that have to be completed before work can begin on site, understand why they are carried out, what has to be provided on a site, and how it is accomplished. Learners will need to be able to demonstrate the use of sketching techniques and associated calculations (areas, volumes, distances, perimeters, time durations).

STUDENTS WILL KNOW AND REMEMBER

Desk-based preconstruction:

- legal requirements: construction health and safety plan, method statements and risk assessments, informing the Health and Safety Executive (HSE)
- planning: scaled site layout plan indicating site accommodation, welfare facilities, storage accommodation, compounds, temporary roads and hard standing, fixed plant, fire precaution measures
- producing a programme of work or scheduling of activities or resources, purchasing of resources, organising safety signs, statutory notices including footpath closures, road crossings, traffic management.

Site-based preconstruction:

- demolition and clearance of existing structures: sustainable demolition and recycling on brownfield sites, tree removal, general site clearance of vegetation
- enabling work: protection of existing services (water, gas, electricity), formation of access and egress routes, installation of temporary supports
- site set-up: fencing, gates and security of the site, temporary lighting, decontamination works, installation of site accommodation and associated services,
- signage, creation of storage compounds and hard standing, temporary works required to construct and support.

Sub-structure groundworks. How sub-structures are constructed safely. For the following, understand what is used, why it is used (including potential hazards), where it is used and how it is achieved. Learners will need to be able to demonstrate the use of sketching techniques and associated calculations (areas, volumes, distances, perimeters).

Site-based preconstruction:

- hazards associated with groundworks: gas, collapse of the sides of the excavation, protection of third parties, movement of ground water, confined space, safe access and egress, overburden, likelihood of collapse due to type of soil, avoiding services, proximity of excavation plant
- control of water: temporary control of sub-soil and surface water during excavation, (simple sump pumping), permanent control of sub-soil water (land drainage)
- earthwork support: methods of support to the sides of the excavation (earthwork support), steel trench sheets, timbering, hydraulic trench supports, aluminium walling
- function of a foundation: to safely transmit the loads of the building to the sub-soil, to settle within acceptable limits for settlement, to support the loads of the building for its lifespan
- understand how foundations are detailed: the different types used to support a low-rise building, detailing and terminology, strip and deep strip, trench/mass fill, raft, short bored piles and ground beam, engineering brickwork to dpc and cavity fill, weep holes, selection of appropriate foundation for a variety of ground conditions, the advantages/disadvantages of each foundation type
- understand how ground floors are detailed: design and construction of ground floors, solid and suspended, beam and block, timber joists, solid concrete, including dampproof course (dpc), damp-proof membrane (dpm), sand blinding, hardcore, thermal insulation (location of insulation), sub-floor ventilation and the advantages/disadvantages of each floor type.

Explore how superstructures are constructed
Superstructures – walls. For the following, understand what is used, where it is used, why it is used and how it is achieved. Learners will need to be able to demonstrate the use of sketching techniques and associated calculations (areas, volumes, distances, perimeters).
STUDENTS WILL KNOW AND REMEMBER
Understand how walls are detailed:
● types of construction (cavity masonry, timber frame, insulated panels (SIPs) and their advantages and disadvantages, wall-tie spacing, internal partitions (timber, metal stud, solid blockwork) ● functions of a wall: to resist heat transfer, to reduce sound transmission, to transfer loads to foundations, to provide shelter, to provide security ● materials used: thin joint masonry, lightweight thermal blockwork, quality of facing bricks, types of mortar and quality ● types of wall finishes: rendered blockwork, facing brickwork (including pointing – bucket handle/tooled, recessed, weathered, flush) and their advantages and disadvantages ● wall openings and their functions: provide ventilation, provide light, provide aesthetics ● components of a wall opening: lintel, sill, window, door, threshold **Learning**, damp-proof course, cavity trays, cavity closers, weepholes, and the function of each ● detailing around wall openings: details of heads, thresholds, sills and jambs, including wall-tie spacing ● functions of detailing: prevention of damp transfer, continuity of insulation, maintaining structural integrity, load distribution.

Understand how floors are detailed:
● understand how floors are detailed: types of construction (intermediate); solid, timber, engineered timber and their advantages and disadvantages ● functions of a floor: to provide a level surface, to reduce sound transmission, transfer loads to walls, to provide accommodation of services
● materials used: stress-graded timber joists, beam and block, eco-joists, engineered timber joists, precast concrete planks ● types of floor finishes: screeded, chipboard, moisture-resistant chipboard, tongue and-grooved softwood floorboards, skirtings
● components of a floor: supporting joists, structure, floor covering, wall support, skirtings, and the function of each.
Topic C.3 Superstructures – roofs. For the following, understand what is used, where it is used, why it is used and how it is achieved. Learners will need to be able to demonstrate the use of sketching techniques and associated calculations (areas, volumes, distances, perimeters).
Understand how roofs are detailed:
● understand how roofs are detailed: types of construction – flat, lean-to, mono pitch, double pitch, gable end, hipped end, their specific maintenance and advantages and disadvantages, the

terminology used to label a roof detail

- functions of a roof: to provide a method of discharging rainfall away from the building, to waterproof the structure, to provide a recreational area, aesthetics, provides additional accommodation/space

- materials used: trussed rafters, traditional timber roof with purlins, breather membrane, tile felt, tile battens, roof tiles, bitumen felt
- types of roof finishes: types of roof finish employed for each type of roof, fixing of finishes, felt and tile battens, three-layer felt construction, rain water goods and downpipes, stages involved in the application of the roof finishes

- components of a roof: common rafters, jack rafters, cripple jack rafters, wall plates, roof trusses, binders, diagonal wind bracing, ridgeboard, fascia, eaves, valley, soffit, gable, hip, dormer window, insulation and the function of each.